DOCUMENT RESUME

ED 360 275 SP 034 602

AUTHOR Wideen, Marvin F.; And Others
TITLE The Research on Learning To Teach: Prospects and Problems.
PUB DATE Apr 93
NOTE 37p.; Paper presented at the Annual Meeting of the American Educational Research Association (Atlanta, GA, April 12-16, 1993).
PUB TYPE Speeches/Conference Papers (150) -- Information Analyses (070)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Beginning Teachers; *Educational Research; Elementary Secondary Education; Foreign Countries; Higher Education; *Instruction; *Preservice Teacher Education; Research Methodology; *Research Problems; Student Teachers; *Student Teaching

ABSTRACT

As part of a larger research progam on learning to teach, this paper reviews 15 empirical studies that followed students through one or more components of their student teaching program. The review focused on teacher development, constructivism (which ascertains how initial experiences in teacher education interact with the preconceptions held by prospective teachers), and knowledge utilization. The review found much variation in the usefulness of the research in informing the practices of researchers and of teacher educators. No consistent message was found with regard to the effects of different facets of programs on the work of beginning teachers. Where constructivist teacher education programs were the subject of study, generally positive claims were made about results, but in other cases, student teaching experiences were so devastating that little learning seemed to take place. A positive feature of the research studies was the fact that the research was being conducted by individuals working in programs of teacher education rather than by researchers twice removed from study subjects. (Contains 34 references.) (JDD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED360275

The Research on Learning to Teach: Prospects and Problems

Marvin F. Wideen, Simon Fraser University
Jolie A. Mayer-Smith, University of British Columbia
Barbara J. Moon, Simon Fraser University

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

M. F. Wideen

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Paper presented at the annual meeting of the American Educational Research Association, Atlanta, GA. April, 1993. (session 42:07). This research was supported by a grant from the Social Sciences and Humanities Research Council

SP034602

BEST COPY AVAILABLE

The Research on Learning to Teach: Prospects and Problems

Context for this study

Few would disagree with the notion that 'learning to teach' is central to programs of teacher education. Yet, surprisingly, until very recently little work had been reported in the area. After a review of the literature on the subject up to 1990, Carter (1990) concluded that the concept of how beginning teaches learn to teach is poorly understood. But since Carter's published review, the growing interest in the area has now led to the publication of a number of studies that follow beginning teachers through their preservice teacher education and occasionally into their first year of teaching (see for example Aitken and Mildorn, 1992 and Hollingsworth, 1989). We have also seen other reviews of this literature produced. Reynolds (1992) has reviewed the literature from the perspective of what constitutes competence in a beginning teacher. She drew primarily on the research on teaching to identify areas to be considered when preparing teachers. Kagan (1992) examined some 30 studies of beginning teachers in their year of teacher preparation in an attempt to learn what those studies implied about teacher preparation programs. Her conclusion that such programs should focus upon procedural knowledge aimed at assisting students with management was contested by Grossman (1992) who argued that beginning teachers are also interested in and capable of addressing wider and more significant issues.

The authors of this review became interested in examining this literature to gain some common platform from which to view the case studies on learning to teach. We undertook a review of over 25 papers, 15 of which are reported in this paper. We selected recent papers on learning to teach that followed students through one or more components of their student teaching program.

Objectives. Within the general area of learning to teach, this review was undertaken with three objectives in mind:

1. To examine how people present their research with a view to informing our practice;
2. To examine how different facets of programs, initiatives and interventions, both within faculties of education and at the school level, affect the work of beginning teachers; and
3. To examine how beginning teachers[1] gain, develop and use knowledge about teaching.

The review reported in this paper was undertaken to provide a basis for further research, as the review was part of a larger research program in the area of learning to teach. In addition, we had hoped to find some consistency to a literature that would improve our growth of knowledge in the field and also assist in program planning. We were particularly interested in the pre-entry beliefs held by beginning teachers about teaching in order to study how, or whether, these beliefs change and under what program circumstances. As the review progressed we began to see the research presentation as increasingly problematic; therefore, this review also takes a critical perspective of the means by which the research was carried out and presented.

Theoretical perspectives

[1] We define a beginning teacher as someone enrolled in an education program or in their first year of teaching.

Although the question of how people learn to teach remains basic to teacher education, the area has only recently attracted the attention of researchers. It is unsurprising therefore that reviewers have found much conceptual diversity, ambiguity, and few cumulative findings (Carter, 1990; Feiman-Nemser, 1986). Carter suggests that the "learning to teach" question requires a framework that focuses on what is learned and how that knowledge is acquired. We adopted as a starting framework three related areas of literature: teacher development, constructivism, and knowledge utilization. The framework we used drew on:

Teacher development. During the 1970s and 1980s, developmental stage theories sought to identify concerns, problems or tasks common to most teachers at various times in their professional lives (Burden, 1990). Recently research has refocussed on dilemmas and meanings about the practices that teachers find important (Lieberman, 1984). This perspective takes a more teacher-centred approach, recognizing the limitations of outsiders who mandate change through programs such as supervision or staff development (Grimmett & MacKinnon, 1991). Learning to teach, from this perspective, is a developmental process. In this review we applied this perspective of teacher development to beginning teachers as well as practicing teachers. What becomes crucial during initial teacher education is how different program elements affect with the development of beginning teachers and set the stage for ongoing professional growth. Therefore, in our review we attempted to ascertain how the authors actually viewed and reported how beginning teachers developed, or learned to teach.

Constructivism. Constructivism has roots in philosophy, psychology and cybernetics; it asserts that those being studied must be understood as knowing beings who actively build knowledge, beliefs and understandings based on previous conceptions. The locus of control for behaviour is within the subject (von Glasersfeld, 1987) who is "self-constructing" (MacKinnon, 1989), continually striving to make sense of his or her own experience.

Constructivism argues that we need to better understand the constructs that subjects hold (Magoon, 1977). It assumes that students enter teacher preparation having views about teaching gained from their previous years of schooling and that changes in the beliefs arise in interaction with some experiences in preservice teacher education but not with others. It follows that we need to ascertain which types of initial experiences in teacher education positively interact with those preconceptions held by the prospective teachers. A study by Hollingsworth (1989), for example, found that such pre-program beliefs served as filters for the program content.

Knowledge utilization and teacher's knowledge. The importance of knowledge, whether it be about subject matter, pedagogy, or implementation remains critical to how teachers learn to teach (Carter, 1990). Earlier views of knowledge utilization held that the lack of reform in education rested on an inability of teachers, cast as users of information, to put into practice knowledge about teaching developed by outsiders (Louis, 1981). An alternative line of inquiry sought to describe in rich and often evocative detail the knowledge that teachers possess and how that knowledge bears on their work. Building on the qualitative approach taken by people such as Kounin (1970) researchers have recently reclaimed this line of inquiry and, according to Carter's (1990) classification, extended it into three areas: information-processing (e.g. Borko, Lalik, & Tomchin, 1987), practical knowledge (e.g. Elbaz, 1983), and pedagogical content knowledge (e.g. Ball, 1988; Shulman, 1987). Although differing in assumptions and approaches, these studies share a theme that examines teachers' implicit understandings of teaching and how these drive their work.

Despite this shift in thinking from earlier views of knowledge utilization ,these studies remain somewhat limited. The studies of practical knowledge (e.g. Elbaz, 1983) focused on the characteristics rather than the substance of what teachers know. Further, many of the studies have not taken into account outside influences, such as the effect of school policies on teachers, that may change people's perceptions about teaching.

These three areas provided a beginning point for our review.

Methodological approach.

The data sources for this paper consists of 15 empirical studies each of which (a) involved an intensive study of beginning teachers in their initial year of teacher preparation and occasionally their first year of teaching, (b) provided information about the programs or program elements involved, and (c) sought to draw out the different elements involved in the learning to teach literature such as pre-entry beliefs and changes in the conception of becoming a teacher. These studies were reviewed from two perspectives. The first assumed an holistic view of the research and to provide a sense of what was being attempted and why the authors were undertaking the research. This part of the study gave us a picture of the procedural side of research and made it possible to comment about the overall direction of the line of inquiry. The second perspective aimed at identifying the substantive findings was more analytical. It involved constructing a detailed summary of each paper that drew out the salient points with regard teacher development, the constructions about teaching brought to the programs by beginning teachers and the researchers themselves, how knowledge was thought of both by the teacher educators and beginning teachers, the nature of the data collected and presented, what program elements were in place in each case, and the implications of the research.

Before discussing the results of our analysis, a comment about methodological problems seems in order. Conducting this analysis required the investment of a great deal of time; we held collaborative meetings for each of the papers. This was done to ensure a common interpretation of the papers. However, many of the studies were difficult to analyze because they lacked sufficient detail. In some cases we were unable to agree on what had taken place during the study and what evidence was being provided to support theclaims being made. In other instances was data included which did not appear to match the conclusions. Thus, while we began with a goal of reviewing 25 papers, the problems we encountered led us to limit ourselves to a more in-depth analysis of 15 studies. The authors make no claim to having reviewed all the recent literature in this area; thus our discussion and any conclusions we present are based solely on the papers here reviewed.

Results

We have summarized the 15 studies in Tables 1 and 2. Table 1 provides basic information about the studies reviewed, including for each paper: author (s) and their role in the teacher education program, the participants who were the subjects of the study, the study elements, and details about the data collection and its presentation. When the studies were analysed in terms of these factors, three themes emerged.

The people doing the research. Our review pointed out a very positive feature of this line of research, namely, these studies were being conducted by individuals working in programs of teacher education. For example, in the second study listed in the table, by Gunstone et al., three of the authors worked directly with the beginning teachers who were the participants in the study. Unlike some areas of educational research, where the

researchers are twice removed from those who are the subject of the studies, those reporting this research were close to the action, if not a part of it. In two of the studies (Gess-Newsome & Lederman; Gunstone et al.), the authors discussed the implications and possible conflicts craeted by acting as both instructors and researchers. This "closeness to the action" led to some situations (albeit limited) where the subjects themselves became quasi-partners in the research. This situation stands in sharp contrast to the research on teaching paradigm which has largely been the province of outsiders. Reynolds (1992) reports that the critics of the research on teaching paradigm question the worth of the findings because of the lack of teachers' voices, the people on whom the research was done. The researcher conducting the studies we reviewed did not appear as the 'distant rationalists' so prevalent in the research on teaching paradigm.

The positive feature of the research we reviewed is that what is being learned can be used to improve programs of teacher education. The data produced was rich as it provided close up accounts of those preparing to become teachers. Those conducting the research appeared to reflect a strong commitment to the field, and a thoughtful and caring approach to their subjects.

Presentation and analysis of data. The closeness of the researchers to the subjects and program often proved to be a mixed blessing. The researchers frequently drew conclusions that did not appear to rest on the data, or if they did, the links were poorly established. It seemed that conclusions may have been drawn from some type of insider knowledge which proved difficult to separate from data presented in the study. Analysis, in many cases, was further complicated by not knowing what the roles of the researchers were in relation to the program.

As Table 1 illustrates, the researchers drew predominantly on qualitative data, mostly in the form of interviews. The authors supported themes and conclusions with selected quotations from those interviews. This we did not find problematic. But often they did not include other sources of data that would triangulate findings. Nor was it clear why some interviews were quoted from and others not. Was a quotation an instance of a type, or did it simply confirm the story the author want to present? We found, on occasion, that the reference groups on which claims were being made shifted during the course of a paper. For example, views at the beginning of the some studies were from one set of students and views at the end of that study were from another set of students.

Our concerns did not stop there. One of the guiding principles of any type of research should be the search for disconfirming evidence (Garrison, 1986). This aspect of data collection and analysis was not mentioned in most studies we reviewed. Does data exist that does not support the emerging themes? We found only three of the 15 studies actually discussed evidence that did not support the predictions of their original framework.

In many of the studies we reviewed the authors did not appear to be sensitive to the data. The data seemed much richer than the conclusions drwn from it. In fact, four of the studies confirmed the uneasy notion that qualitative research has, in some cases, become a synonym for weak research.

Usefulness of the research to inform our practice. This research has the potential to inform two aspects of our practice: the practice of research in teacher education, and teacher education practice itself. As researchers in teacher education we find it valuable that this research has the potential to include the authentic voice of the subjects being studied. This should allow us to read and draw our own conclusions for the data being presented. However, (as was mentioned earlier), as these papers include only very limited samples of the data, their usefulness for this purpose is restricted. At another level, this research has

high utility as action research in that the people doing it are also those who work to prepare the beginning teachers for the profession they are entering.

As we said at the outset of this section, at one level this research has high utility in that the people doing it are also those who work to prepare beginning teachers for the profession they are entering. However, few of authors of the papers we analysed had much to say in a reflective way about how the research they had conducted might be improved. How can we learn from other people's research experiences if they are not going to be publicly self-critical?

In Table 2 we have summarized the studies according to the educational program objectives, theoretical orientations of the studies, and major findings and implications of how people learn to teach.. Five themes emerge.

The new enlightenment. The community of teacher educators undertaking this research have discovered constructivism. This has become the new conceptual structure which drives programs for beginning teachers. This is manifested in the methods courses that present, and occasionally model, constructivist teaching, and in new teacher education programs that are designed to provide a unified constructivist experience for student teachers. A positive feature of this new development is that it provides some conceptual consistency to a field that Carter (1990) characterized in terms of conceptual diversity and ambiguity.

A negative aspect of this enlightenment is the way in which the new knowledge and understanding about constructivism is sometimes used. In some of the programs perscription has been built into the notions of constructivism. These studies claim students bring diverse and strongly held views to their learning to teach programs and need to construct meaning in different ways. Yet students are led step-by-step through procedures designed to facilitate conceptual change and to promote construction of meaning. In many cases the type of meaning that they are to construct is specified. It is ironic that these programs recognize and celebrate the very diversity of entering views that they deem inappropriate. An example of this is shown in table 2 in our summaries of "Objectives of teacher education program" and "Major findings". Are we in the process of replacing dogma with dogma?

The issue of control. One of the issues that emerged from our re-analysis of the authors' data involved the perception of control on the part of the student teacher. Gess-Newsome and Lederman, Haggerty, Johnston, and Smith describe conflicts arising at a personal level in the practicum, but do not treat it as a major theme.

When we examined the interview data from several studies, we found the issue of perceived control on the part of the students to be central to the process of learning to teach. Frustration was frequently expressed by students about the need to follow the practice of the cooperating teacher; they also had to deal with conflicting demands from their university and school supervisors; they felt the tension of being expected to learn and implement brand new strategies while simultaneously being evaluated (the results of which could make or break their careers), and some perceived that the cooperating teacher (the "real" teacher in the eyes of the pupils) was still in charge even though they sat at the back of the room. A central concern for all the student teachers was the issue of classroom management. It was obvious that many student teachers felt that the pupils were in control. Thus they expressed frustration with university course work which had little relevence to their work in classrooms. They felt this lack of direction impeded their learning how to teach.

What the student teachers' voices seemed to be saying was that they found themselves exercising little control during their practicum and further that their university experiences were not equipping them to take charge at this crucial point in their emerging careers. Constructivist perspectives speak about the locus of control of learning residing within the learner. In these contexts where the learner feels powerless, is it any wonder that the student teacher retreats to a passive stance and hopes merely to survive the experience rather than feeling that they are able to learn from it? We should not be surprised then that so many student teachers emerge from this experience just hoping to adapt to the existing schooling system.

Program effects. All the studies assessed the courses and programs in terms of their ability to facilitate change in student teachers' conceptions. Most included the practicum as part of their analysis. Eight of the studies reported success in changing student teachers' conceptions, 2 reported mixed results, and 4 felt that the program interventions were unsuccessful. The Hewson et al. study which described a new conceptual change orientation for a pre-service program predicted success for the program interventions based on success in similar contexts.

All studies that reported success in bringing about conceptual change included opportunities for individual or collaborative analysis and reflection. Entering views of student teachers were typically elicited at the beginning of a course. Then, in some cases, course events were designed to challenge students' existing conceptions (Fosnot, Gunstone et al., and Hewson et al.). More commonly the course experiences provided naturally occurring cognitive conflicts in which students found their views inadequate to deal with the issue at hand. Throughout their education year students were required to analyse and reflect on these experiences and ,often, asked to reflect on their beginning views.

These findings about conceptual change support the common view about the difficulty in changing the beliefs about teaching that beginning students bring into the program. All the studies that took a constructivist perspective, talked about these strongly held views (mainly emphasizing views about subject matter structure and about teaching and learning). There was a tendency for students to accept new ideas that agreed with their existing views and reject those that conflicted. The studies of Wubbels et al., Roberts and Chatsko, and Stoddart et al. (2) point out that the most difficult views to change are those about teaching and learning. Traditional views about the subject matter held by beginning teachers seem easier to change (e.g. Gess-Newsome and Lederman). It was not clear from the results in some of the conceptual change program studies, such as Fosnot, Gunstone et al. and Stoddart et al.(1), what the program's success was in producing the desired conceptual change in their student teachers. They implied, by omission, that all the student teachers in conceptual change programs changed to the appropriate conceptions in the time allotted. From a constructivist perspective this hardly seems credible.

As discussed above, the practicum seemed to be the most difficult experience for student teachers. Teacher education programs and researchers seem to respond differently to this challenge. Many programs try to help students by trying to be generally supportive within the constraints of time, costs, and the existing school situation. This is probably the most common situation in the field at present. Johnston and Hewson et al. suggest that student teachers need to be given the skills to be able to cope in a traditional school setting. Fosnot and Haggerty take an alternate view that the teacher education program should play aa active role in establishing a practicum setting that is supportive of innovative teaching. Methods courses were perceived by students as being the most useful preparation for the practicum, but few studies reported on what aspects of these courses were used in classroom practice.

Some of the studies, (Fosnot, Hewson et al., and Stoddart et al. -1) take as one of their operating principles the concept of action research for their student teachers. In this view the locus of control resides with the student teacher-researcher. An action research focus encourages student teachers to regard their teaching as problematic and supports them to be active problem solvers in charge on finding their own solutions during the practicum.

In the six studies reporting a lack of success or mixed results, there seemed to be two major reasons for the lack of change. There were no direct challenges to student teachers' views; there seemed to be an expectation that the students would learn by example. Wubbels et al. further postulate that images of teaching are held in the right hemisphere of the brain. They argue that using logical and analytical (left brain) techniques for reflection are less likely to be successful. In other cases the difficulty of the practicum experience seemed to sabotage the student teachers' ability and inclination to do other than just survive; this was linked, in the students' minds, to lack of adequate preparation by their course work.

The voice of the student teachers. If there was a unified voice that emerged from this research it was found in the voices of the student teachers. In situations where students were struggling for control, we heard frustration, anger, and bewilderment. When students were supported by program, peers, and classroom situations, and where deliberative exploration and reflection were encouraged, we saw the flowering of empowered teachers. Here we heard from individuals who experienced the satisfaction of discovering connections between the teaching situations they created and their pupil's learning, people who were not afraid to experiment, struggle, and make mistakes; teachers whose transcripts expressed a sense of joy at their emerging understanding of what it is to be a teacher.

Areas of omission and prospects for research. Through our conceptual frame we set out to examine knowledge and its use in teacher education. Although references to knowledge appeared in many of the papers, it was usually not dealt with in a direct way. This is a difficult area to study, but in need of strong research in order to inform our efforts to improve teacher education. In some cases the paucity of the students' practicum experience overrode considerations of knowledge. Johnston, for example, set out to explore the growth of personal practical knowledge of students during the practicum. But in her results she contends that the many constraints on the student teacher's practicum experience, including their narrow view of what constitutes learning, limited their ability to learn to such an extent there was little to talk about in terms of knowledge.

Three studies (Hewson et al., Stoddart et al. -1 and Wubbels et al.) dealt with student teachers' views of subject matter structure and knowledge in their descriptions of program events designed to facilitate conceptual change. We acknowledge that several of the researchers whose work we review here have published studies, on teachers' beliefs about subject matter and teaching and learning, that should be read in conjunction with their papers reviewed here. Gess-Newsome and Lederman, in the one study that dealt directly with subject matter conceptions, point out that there seem to be few projects that study changes in these conceptions over the long term. We would claim further that, in the field of pedagogical content knowledge research, there is a need for studies that span pre-service and the first few years of teaching.

Other key players that are very important in teacher education are the faculty supervisor and the cooperating teacher. With regards to the cooperating teacher, for example, it would be productive to know about their views of how beginning teacher learn to teach. Several of the studies we reviewed raise the issue of dissonance between what the teacher education programs are trying to accomplish and the teaching styles prevalent among the cooperating teachers. Other authors make reference to cooperating teachers assuming

various approaches to student supervision such as 'sink or swim', 'teach as I teach', 'give me a holiday from my students' or 'I will play a supportively reflective role'. Much is suggested but little appears to be known about the impact these different approaches have upon students. Students make reference to the tension of having a faculty supervisor who is responsible for both coaching and evaluation. In this situation, most students will likely opt for a conservative approach and remember the evaluative role in their approaches to their faculty supervisor. None of the studies we reviewed had interviewed cooperating teachers or faculty supervisors.

Discussion and conclusions

This study originally set out with three objectives in mind and, as in many of the studies we reviewed, our results led us away from these objectives. Our first objective, which was to examine the research with a view to informing our practice, has been addressed in different ways through out this paper. Generally we found much variation in the usefulness of the research in informing our practice as researchers and as teacher educators. The usefulness of this research may well lie in helping teacher educators treat it as case studies with a wealth of data to be read and analyzed. For our second objective, we found no consistent message with regard to program effects which is not surprising in light of the diversity of the programs being discussed. On the one hand, where constructivist teacher education programs were the subject of study, generally positive claims were made about results. In other cases, the student teaching experiences were so devastating that little learning seemed to take place. With regards to beginning teachers' use of knowledge, our second objective, few of the the papers we reviewed dealt directly with this aspect of learning to teach.

In drawing this paper to a conclusion, we have identified a number of problems, as have other reviewers. By now the pitfalls of this line of research have been well documented. In contrast, the emerging conceptual frame around the notion of constructivism provides a positive feature of this research. Despite its complexity, the area appears to carry some consistent meaning to those who have reviewed the literature as conceptual background to their study. Of the 15 studies we reviewed 13 dealt drew on constructivism as a conceptual backdrop. As we pointed out earlier all studies focused on student teachers' changing conceptions.

In this paper we identified, as another positive side of this research, the fact that it was being done by people who were 'close to the action'. That positive feature brings with it a price: inconsistency of design and data collection. In contrast to the research on teaching paradigms which saw outsiders set up fairly consistent studies of teaching, in which they tended to study naturally occurring events, the people doing the research we reviewed were often part of the system they were trying to study. As instructors, researchers naturally tend to focus on the aspects of the education program in which they are involved. Second, as compassionate researchers, instructors are often to reluctant to increase their students' already heavy workload which restricts the possibilities for data collection . Further, because the research is taking place in a diversity of contexts, we would expect a diversity of research goals, designs and outcomes. Perhaps it is time we begin to recognize this as a strength.

BIBLIOGRAPHY

Aitken, J. L., & Mildon, D. A. (1992). Teacher education and the developing teacher: The role of personal knowledge. In M. Fullan & A. Hargreaves (Eds.), Teacher development and educational change (pp. 10-35). London: The Falmer Press.

Ball, D. L. (1988). Prospective teachers understanding of mathematics: What they do bring with them to teacher education. Paper presented at the meeting of the American Educational Research Association, New Orleans.

Borko. H., Lalik. R. & Tomchin, I. (1987). Student teachers' understanding of successful teaching. Teaching and Teacher Education, 3, 77-90.

Burden, P. (1990). Teacher development. In W. R. Houston (Ed.), Handbook of research on teacher education. New York: MacMillan.

Carter, C. (1990). Teachers' knowledge and learning to teach. In W. R. Houston (Ed.), Handbook of research on teacher education. New York: MacMillan.

Elbaz, F.(1983) Teacher thinking: A study of practical knowledge. London: Croom Helm

Feiman-Nemser, S. (1986). Learning to teach. In L. Shulman & G. Sykes (Eds.), Handbook of teaching and policy. New York: Longmans.

Fosnot, C. T. (1992, April). Learning to teach, teaching to learn: the center for constructivist teaching/teacher preparationproject. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Garrison, J. W. (1986). Some principles of post positivistic philosophy of science. Educational Researcher, 15 (9), 12-18.

Geddis, A. (1991, June). Researching the growth of pedagogical content knowledge in novice teachers and teacher educators. Paper presented to the annual meeting of the Canadian Society for Studies in Education, Kingston Ontario.

Gess-Newsome, J. and Lederman, N. G. (1993). Preservice biology teachers' knowledge structures as a function of professional teacher education: a year long assessment. Science Education, 77(1), 25-45.

Grimmett, P. & MacKinnon, A. (1991). Craft knowledge and the education of teachers. Review of Research in Education

Grossman, P. L. (1992). Why models matter: An alternate view on professional growth in teaching. Review of Educational Research, 62(2), 171-179.

Gunstone, R. F., Slattery, M., Baird, J. K., & Northfield, J. R. (1993). A case study of development in preservice science teacher. Science education, 77(1), 47-73.

Haggerty, S. M. (1992, June). Becoming a science teacher: "waddling in amongst the quagmire". Paper presented to the annual meeting of the Canadian Society for Studies in Education, Charlottetwon, P.E.I.

Hewson, P. W., Zeichner, K. M., Tabachnick, B. R. , Blomker,K. B., & Toolin, R. (1992, April). A Conceptual change Approach to Science Teacher Education at the University of Wisconsin-Madison. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Hollingsworth, S. (1989). Prior beliefs and cognitive change in learning to teach. American Educational Research Journal, 26(2), 160-189.

Johnston, S. (1992, April). Experience is the best teacher .... or is it? Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Kagan, D. M. (1992). Professional growth among preservice and beginning teachers. Review of Educational Research, 62(2), 129-169.

Kounin, J. S. (1970). Discipline and group management in classrooms. New York: Holt, Rinehart & Winston.

Lawrence, C. L. (1992). Preservice teacher's development of pedagogical understandings and epistemological frameworks. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Lieberman, A. (Ed.) (1984). Rethinking school improvement. New York: Teachers College Press.

Louis, D. (1981). External agents and knowledge utilization: Dimensions for analysis and action. In R. Lehman & M. Kane (Eds.), Improving schools. Beverly Hills, Calif.:

MacKinnon, A.M. (1989). Conceptualizing a reflective practicum in constructivist science teaching. Unpublished doctoral thesis, U.B.C., Vancouver.

Magoon, A. J. (1977). Constructivist approaches in educational research. Review of Educational Research, 47(4), 651-693.

Powell, R. R., and Riner, P. (1992 April). The origins of teaching: A study of teacher development in secondary career-change preservice teachers. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Roberts, D. A. and Chastko, A. M. (1990). Absorption, refraction, reflection: an exploration of beginning science teacher thinking. Science Education, 74(2): 197-224.

Schneider, C. and Ammon, P. (1992, April). A microgenetic analysis of restructuring in a teacher's understandings about learning and teaching. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Shapiro, B. L. (1991). A collaborative approach to help novice science teachers reflect on changes in their construction of the role of science teacher. Alberta Journal of Educational Research, 37(2): 119-132.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1-22.

Smith, R. L. (1993, April). The evolution of preservice teachers' orientations during early field experiences and initial teacher education course work. Paper presented at the annual meeting of the American Educational Research Association, Altanta, GA.

Stoddart, T., Stofflett., & Gomez. (1992, April). Breaking the didactic teaching-learning-teaching cycle: Reconstructing teacher's knowledge. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

von Glasersfeld, E. (1987). Constructivism. In The international encyclopedia of education. Oxford: Pergamon Press.

Wubbels, T., Korthagen, F., & Dolk, M. (1992 April). Conceptual change approaches in teacher education: Cognition and action. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Table 1
Basic Information Table about the Studies Reviewed

Researchers & Position in Program	Participants	Study Elements	Data Collected	Data Presented
Fosnot 1992 —not stated	Thirty elementary student teachers with liberal arts backgrounds.	One year post-grad pre-service program followed by 1 year F/T internship (Centre for Constructivist Teaching, Southern Connecticut State U.).	Participants' journals and synthesis papers, observations of practicum and intern year.	Excerpts from journals and synthesis papers of four student teachers, field observations.
Gess-Newsome & Lederman 1993 —course instructors.	Ten secondary biology student teachers in their final year of BS in Science Education.	Science Methods, Microteaching, and Practicum courses followed by field-based practicum.	Questionnaires at beginning, mid-point and end of course work; questionnaire & interview midway through practicum. —includes protocols	Results, excerpts and diagrams from beginning questionnaire; excerpts and diagrams from last questionnaire; interview reflections on responses & practicum. —corroborative analysis done separately
Gunstone, Slattery, Baird & Northfield 1992 —instructors and uninvolved researchers.	Thirteen secondary science student teachers in a seminar group who completed the program.	One year post-grad Dip.Ed. program at Monash University (doesn't include practicum observations)	Entry interview, participants' journals, individual & group interviews (often task-focussed), written evaluations, summative reports by participants.	Summarized views & perceptions; excerpts from case studies of four student teachers, excerpts from interviews and summative reports of each student Teacher. —discussed triangulation of data to check for reliability and validity
Haggerty 1992 —not stated	Two groups of secondary student teachers (one science & one with science as a minor).	One year post-grad programs at two Canadian universities (includes practicum).	Interviews, questionnaires. Entry interview at one institution, entry questionnaire of views of science at both. —includes protocols	Interview excerpts from entry, mid- and end-point of program, exemplars of tensions in teacher education program.

Researchers & Position in Program	Participants	Study Elements	Data Collected	Data Presented
Hewson, Zeichner, Tabachnick, Blomker & Toolin 1992 —not stated	Two "cohorts" of science student teachers (1 elementary & 1 secondary)	One year post-grad pre-service at University Wisconsin-Madison (includes practicum)	Descriptions and transcripts of methods course activities, interviews with teacher educators, observation of action research projects in practicum.	Descriptions of conceptual change methods course activities and excerpts of classroom dialogue.
Johnston 1992 —not stated, but not a course instructor	Eight student teachers in the last year of a three year program.	Final practicum (length?) at a US and Australian university.	Four to six interviews and classroom observations, interviews were coded and categorized according to the way in which LTT process was described.	Excerpts from interviews presented in different categories relevant to the LTT process (e.g. developing routines), early and late responses.
Lawrence 1992 —course instructor	Seventy-two 2nd year student teachers (all levels).	Introductory Education Psychology course at Purdue University.	Open-ended course evaluation, course portfolio —includes protocols.	Tables of student teachers' responses to portfolio tasks, tables of levels of pedagogical understanding.
Powell & Riner 1992 —participant observer.	Three non-traditional secondary student teachers.	Four semester Teacher as Decision Maker Program at Indiana SU (includes practicum)	Entry interview, four sequential concept maps with interviews, stimulated recall of peer and practicum teaching, journals, practicum observations.	One beginning concept map, excerpts from early and later interviews, journal excerpts.
Roberts & Chastko 1990 —course instructors	Two secondary science student teachers	Science Methods course (1 semester) followed by practicum at University of Calgary.	Transcripts of student analysis and reflections of peer teaching (early) and practicum teaching (late).	Excerpts from videotape analysis transcripts (early peer analysis and a later student teacher analysis) from two different student teachers.

Researchers & Position in Program	Participants	Study Elements	Data Collected	Data Presented
Schneider & Ammon 1992 —not stated	One elementary student teacher	Two year post-grad program at UC Berkeley (includes practicum)	Entry and exit interview, student fills out weekly standard form	Sequential excerpts from student teacher's journal
Shapiro 1991 —course instructor	Twenty-three secondary science student teachers.	One semester (7 weeks of science methods + 4 weeks of practicum) at University of Calgary.	Interview and survey information prior to and following methods course, and during practicum, sets of students' personal constructs.	Interview excerpts, samples of student statements sorted into change categories created to analyze how students were changing.
Smith 1993 —participant observer	Six middle grade student teachers who shared a language arts orientation.	One semester of methods course + practicum at University of North Carolina.	Two inventories, entry & subsequent interviews, a reflective scoring guide, portfolios, group discussions, and investigators' field notes.	Sequential interview excerpts, classroom observations, early and late responses.
Stoddart, Stofflett & Gomez 1992 (1) —not stated	(1) Twenty-seven seniors in an elementary science program (1 section of conceptual change methods & 1 traditional methods). (2) One student teacher from each section in practicum.	Ten week methods course followed by practicum in mid-western university.	(1) Pretest and posttest interviews on understandings using "Interview about events" approach, lesson plans and peer teaching observations. (2) Videotape of practicum lesson + post-lesson reflection paper.	(1) Comparison of pretest and posttest scores from the two sections, examples of responses from pretest and posttest interviews. (2) Description of lesson events and excerpts from reflection paper.
Stoddart, Stofflett & Gomex 1992 (2) —researchers	Four secondary English student teachers.	Pre-service year & first year of teaching (data from National Center for Research on Teacher Education 'Learning to Teach' Study).	Entry and exit interview, classroom observation and interview in first year of teaching.	Exit views after preservice, description of lesson events and excerpts from interviews in first year of teaching.

Researchers & Position in Program	Participants	Study Elements	Data Collected	Data Presented
Wubbels, Korthhagen & Dolk 1992 —not stated	Primary: ten secondary mathematics student teachers; secondary: teacher educators	Four and one half year SOL secondary math teacher education program at Utrecht University (doesn't include practicum observations)	Student teacher questionnaires, interviews, and videotapes of clinical supervision interviews; interviews and questionnaires from teacher educators; questionnaire about mathematics from practicing teachers	Tables of student responses about teaching and mathematics, comparison of views about mathematics between student teachers and practicing teachers, interview excerpts from student teachers

Table 2
Objectives and Major Findings from the Research

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about How People Learn How to Teach
Fosnot 1992	A constructivist approach that begins with student teachers' entering beliefs and subsequently challenges them through activity, research on pupils' views, reflection and discourse in course work and practice. The program is designed to develop and support constructivist teaching practice in student teachers and in the local school districts in which the teachers are placed.	Constructivism suggests that a radically different approach to instruction needs to be taken in which learners are given a unified set of opportunities for concrete, personally meaningful experiences through which they can search for patterns and build concepts in a community of learners.	A deliberately designed, total immersion, constructivist teacher education program, in which "teachers' beliefs are illuminated, discussed, and challenged" in on-campus and field experiences, will successfully promote changed practices of teaching, from traditional to constructivist. —The number of teachers at the end of the program who met the criteria for successful "paradigm shift" was not specified.
Gess-Newsome & Lederman 1993	None described	The authors contend that although possession of subject matter structures (SMS) can be expected to translate into coherent views of biology and thus help teachers select appropriate topics, there is little research to validate this intuitive link. The elucidation of the nature, source and stability of student teachers' subject matter structures in biology; and how these SMS are related to teaching will contribute to the ongoing discussion about teacher's subject matter knowledge.	Most students entered their education courses unable to articulate a subject matter structure for the biology they would be teaching. In general, they listed the biology courses they had taken at university. In addition, they were very hesitant about the task at the beginning and uneasy that they were being tested on their content knowledge. The source of their topics was the school and university courses they had taken. The discrete nature of these early topic listings suggests that the unconnected way in which they are taught undergraduate biology may be simply carried into their public school teaching unrecognized and unaltered. The authors found that the isolated nature of these SMS were malleable and easily influenced by reflection on subject matter knowledge and content specific education courses. Although views about content remained essentially the same, the students reported that they now could see connections between topics and conceptualized the topics in relation to teaching and students. During the practicum, these SMS changed further as the student teachers became aware of their pupils' needs and abilities and as topics were broken down and reorganized into smaller pieces for teaching. The importance of relevance and showing interconnections between concepts was a re-occurring theme. However, most felt that the demands of classroom management and day-to-day concerns restricted their ability to carry out their ideas about integration and themes. The authors contend that subject specific courses are able to develop coherent SMS, but that these do not translate readily into teaching practice.

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about How People Learn How to Teach
Gunstone, Slattery, Baird & Northfield 1992	The authors describe 7 propositions which underlie the program framework and which lay out a constructivist view of learning. The students are grouped into small seminar groups, communities in which learning and constructing meaning take place.	The authors take the constructivist view that student teachers come to programs with well-developed but often simplistic views of learning that are often at odds with those we wish to cultivate. Failure to challenge those views can often leave them unchanged.	The authors evaluated the propositions of the program. Their conclusions include: the importance of personal reflection in facilitating the development of task-related competencies and general intellectual development; the central role played by student seminar groups in providing a safe context in which to attempt change; and the need to create valid links between course work and broad issues of teaching, learning, curriculum and schooling. Their evidence was inconsistent with the notion that individuals progressively and sequentially address different levels of concern. They suggest that the different types of concerns need to addressed in an integrated manner from the beginning. —The number of teachers at the end of the program who met the criteria for successful constructivist teaching was not specified.
Haggerty 1992	One university has a mixed agenda with a behaviorist Principles of Teaching course and an enquiry-oriented methods course as central campus components. The other university has no formally agreed upon mission or vision with faculty having a high degree of autonomy in terms of approach and course content.	Constructivist. The author uses 3 theoretical perspectives (Zeichner's paradigms for teacher ed, '83; Zeichner & Gore's paradigms of teacher socialization, '90; and Car & Kemmis' views of professional teacher competence, '86) to create 5 conceptions of teaching which consider the goals of the teacher education and the approach of the program and are also used to examine student teachers' views (traditional craft, technical, practical, philosophical, and critical).	Most students entered the program with little understanding of what teaching was about. After several months of the program, most students shifted the focus of their responses from themselves as teachers to an awareness of their pupils' needs. Some student's ideas did not change. At the end of the program, most student teachers reflected the Practical conception; their task as student and beginning teachers was to adapt to the existing school system. The Traditional Craft conception, in which student teachers learn how to teach by imitating successful teachers, was encountered most frequently by students in practica at both universities. Several students were frustrated by being expected to teach as their sponsor teachers taught and many were pressured to cover the content "at all costs". The students were mixed in their views of the value of their course work. The Principles of Teaching course, based on the behaviorist Technical conception was never mentioned by any student as influencing their ideas about teaching or their practice. The universities do not appear to be making meaningful links between theory and practice. Few of the students saw the value in having a theoretical framework for their practice. The students were not bothered by the variety of conceptions in their program to which they were exposed. They tended to accept those that were consistent with their own beliefs and reject the others. The author contends that it is not sufficient to merely describe and encourage beginning teachers to use innovative practices without providing the support for innovation in the practicum. The author asks what is the impact of a Traditional Craft orientation in most sponsor teachers? Should this have implications for the selection of sponsor teachers? Finally, if beginning teachers adopt the Traditional Craft or Practical approach as indicated by this study, the status quo will be inevitably maintained

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about How People Learn How to Teach
Hewson, Zeichner, Tabachnick, Blomker & Toolin 1992	The teacher education program "aims to prepare teachers who hold appropriate conceptions of teaching science and who are disposed to put them into practice." The program also tries to give student teachers coping strategies for doing conceptual change teaching in traditional schools.	The general approach is constructivist. The authors review the literature on action research, constructivist science teaching and teacher education and evaluate their program against criteria in these literatures. They also develop criteria that serve as indicators of conceptual change teaching.	This study provides an evaluation of the elements of the program course work that is illustrated by descriptions of classroom activities and examples of classroom dialogue. The courses model: elicitation and diagnosis of prior beliefs, observation, acceptance of alternative explanations, a safe climate for exploring and sharing personal conceptions, student-driven investigations in which they come to challenge their previously held beliefs, scientists theories which are seen to be more fruitful than their own, and opportunities to elicit and diagnose pupil's conceptions. The action research emphasis in the teacher education is based on Deakin University's Action Research Planner (Kemmis & Taggert, '88). The student teachers are introduced early to the idea of action research and then complete action research projects during their practicum . "Action research encourages teachers to regard their teaching as problematic." The authors state that the failure of most preservice teacher education programs is because of their failure to address the conceptions teachers bring to programs and their failure to confront and overcome the theory-practice gap. Their integration of conceptual change teaching and action research is designed to address these two problematical areas. Based on their experience in the last decade the authors state, "we have reason to be optimistic ... that changes are possible within the context of pre-service teacher education and that our linking of conceptual change and action research will result in many of our students using a conceptual change approach to teaching science once they leave our program." The next study will describe the views of the students as they learn to teach science.

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about How People Learn How to Teach
Johnston 1992	None described.	The author's aim was to explore the growth personal practical knowledge of student teachers during practicum. The practicum was presented as an important but poorly understood contribution to the learning to teach process. The author contends that there is an urgent need to conceptualize more adequately how practicum experiences contribute to learning to teach.	The following issues arose in interviews with student teachers during their practicum: most of the student teachers took a passive attitude to their practicum in which they participated willingly but had few expectations; modeling by the sponsor teacher was an important influence for some but others were forced to "sink or swim" in the absence of a model; learning by doing was seen as the most important experience during the practicum; developing automatic routines was important to allow students to concentrate on other aspects of teaching; and students expressed discomfort with learning through trial and error while simultaneously being evaluated. For some students the practicum experience was so difficult that they doubted they were learning anything at all. For others the lack of scope to experiment in the classroom limited their ability to learn from the experience and contributed to their frustration. In addition, the practicum was seen by many as an artificial experience set in another person's classroom. The author finds that the student teachers' narrow view of what constitutes learning in the practicum (i.e. creating innovative lessons) limits their ability to learn from their experience. Since many student teachers are bound to be placed in less than desirable teaching situations, the author argues that teacher education programs have a responsibility to promote good teaching while also enabling them to learn in whatever situation they may find themselves, using these experiences as a "scaffold" from which to develop their own teaching. As long as student teachers regard the practicum as building up a stock of experiences, it will always be a deficit experience. Teacher educators must help student teachers learn to reflect on the meaning of their experiences, in other words, help them learn how to learn how to teach.
Lawrence 1992	None described.	The author takes a constructivist educational psychology approach in teaching about cognition. A stage theory approach appears in the cognition constructs to be taught: levels of cognitive complexity; informal reasoning frameworks; and personal frameworks for evaluating knowledge.	The results came from an open-ended course evaluation and course portfolios. The author states that the development of pedagogical understanding is facilitated when student teachers have deeper approaches to learning and when they develop cognitive frame works for interpreting their knowledge and experience. The study indicates that those who develop a reflective approach to learning will more easily understand and develop conceptions about how their pupils learn. As participants explored their own ideas about epistemology and pedagogy their self-confidence about teaching developed. The author argues that a major focus of educational psychology courses should be to develop student teachers' conceptions of their pupils' learning as a process of active construction. An analysis of the usefulness of the course tasks is also included.

23

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about how People Learn How to Teach
Powell & Riner 1992	"One purpose of teacher education programs should be to assist emerging teachers to restructure their initial views into those that are more pedagogically mature."	Schema theory, as the conceptual grounding, is used as a means of learning how people construct and organize their frameworks. The schemata develop and change with time. Teachers come into teacher education programs with previously constructed, idiosyncratic views of teaching and learning. The study looked at the interaction between former experiences and current teacher education experiences.	The student teachers brought different things from their work experiences. These experiences seemed more important than their school experiences, which seems to be mostly negative. In two cases prior experience was helpful, in the other not. Prior experiences faded as the student teachers moved through their program. Their mentor teachers became very important. The authors argue that student teachers should become aware of their thinking and have experiences that encourage reflection. The conclude, "there is a pressing need to personalize teacher education, to acknowledge and explore preservice teachers' personally constructed pedagogical knowledge, and to help preservice teachers reflect on and restructure their own cognitions as they become teachers."
Roberts & Chastko 1990	None described, but the authors state that science teacher education programs must be concerned with students' thinking about the events of science teaching as well as the rehearsal of behaviors.	The paper presents an analytic framework for analyzing thinking about science teaching events, a "Science Teacher Thinking Framework" (STTF). They talk about the importance of reflective thinking and describe associated alternative events of "absorption" (simply taking it in) and "refraction" (turned aside).	The STTF is presented as a "view-affording lens" (Schwab, '71) through which student teachers can learn to analyze and reflect on their own teaching. They propose 4 essential categories that must be considered in conceptualizing and reflecting on science teaching: subject matter; teaching strategy; objectives; and student responses. The first example, a group reflection on peer teaching set early in a methods course, shows that opportunities for reflection were turned aside by the students' tendencies to make superficial comments, to complement each other's teaching, and to express personal preferences rather than using the 4 reflective categories. As the authors point out, at this point in the students' year they are not cognizant of what it means to teach and are also inexperienced in the use of the framework. In a later reflection on a videotape of a practicum lesson, a student teacher demonstrates an attention to uniqueness of events and individuals and successfully uses all 4 analytic categories. Although most students learned to use the technique successfully, some students resisted to the end (e.g. "who needs this", "everything was fine", "haven't you forgotten something"). The STTF is also proposed as a schema for lesson and curriculum planning.

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about How People Learn How to Teach
Schneider & Ammon 1992	The Developmental Teacher Education Program emphasizes integrating developmental theory with teaching.	Uses a stage theory of learning to teach: developing pedagogical thinking involves progressing through 5 stages: empiricist and behaviorist conceptions, followed by 3 constructivist conceptions. Teacher behaviors move from transmissive teaching to helping students examine their own thinking.	The authors state that there is evidence to show that many experienced teachers have not progressed beyond stage 3 (global constructivism) and that reaching level 4 does not come easily. Sequential excerpts from a teacher's journal show how the teacher progressed through stages 2, then 3, to 4 in 2 years. They state that the teacher's "pedagogical thinking developed through conflicts arising when her previous ways of thinking about issues related to teaching and learning were inadequate in new classroom situations." The authors suggest that teacher educators can use this microgenetic analysis of teachers' journals to engage them in thoughtful, developmentally appropriate activities and discussions.
Shapiro 1991	Not stated.	Constructivist perspective of teacher development. The principles of personal construct theory (Kelly, '69) are used to explain the ways that student teachers understand changes in their experience.	The student teachers developed sets of personal constructs at the beginning of the methods course. Later in the program the students reviewed and reflected on the changes in the categorizations of the personal constructs. This demonstrated to the teachers how they had changed. The author states that this self-recognition of change is important to the process of learning to teach by providing a focus for discussion. Further the author argues that the change categories used in a collaborative context have the potential to help the student teacher keep a focus on their development as an educator while trying to survive the practicum. —No information provided on the number of teachers who changed successfully.
Smith 1993	The intent of the teacher education program is to encourage reflective practice, student-centred approaches, a constructivist perspective, and "artistic problem solving"	Perspectives in the form of preconceived notions about teaching guide and shape teachers' thinking. The author also draws on reflective teaching and discusses early field experience as a way to provide beginning teachers with their views of teaching.	The teachers started with humanistic views of teaching that stressed the affective side of learning. As they progressed to teaching classes their views began to change and become obsessed with classroom management. They struggled with their conceptions of teaching as well as with planning lessons. The students criticized their methods course for not providing "recipes" for successful teaching and for emphasizing a communications approach while the schools were emphasizing isolated skills. The author recommends the use of individualized approaches in teacher education.

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about How People Learn How to Teach
Stoddart, Stofflett & Gomez 1992 (1)	Not stated.	Constructivist. The authors hypothesize that the experience of learning science content personally through conceptual change methods would have a greater impact on teachers' conceptions of pedagogy than observing or being told about such methods.	Entering interviews revealed no differences in science content understanding and pedagogical knowledge between the elementary student teachers in the traditional and the conceptual change classes. At the end of the methods course there were significant differences in scientific understanding between the two classes, with the conceptual change class being higher. Non-significant qualitative differences were also found in the desire to use innovative methods, to change to non-textbook orientations, to take more science courses, and to defend use of teaching strategies with student-centered reasons. When teaching, the teacher from the traditional section had a superficial knowledge of constructivism that was used occasionally (and often incorrectly) in reflections. Despite her traditional teaching, she believed she was using a conceptual change approach. The teacher from the conceptual change class demonstrated, both in her cognition and practice, a change from traditional views to more conceptually-based teaching. —No information is presented on the number of teachers who, at the end of the teaching practicum, met the criteria for a change to more conceptually-based teaching.
Stoddart, Stofflett & Gomez 1992 (2)	Not stated.	Constructivist. The authors discuss how content specific pedagogical knowledge and practice is mediated by other perspectives.	Four humanities secondary student teachers who took extensive teacher preparation in writing as a process were thoroughly committed to this approach by the end of their teacher program. In practice, only one teacher used the writing process curriculum. The other 3 all adopted a skills based drill and practice curriculum. It became clear that their instructional choices were linked to their views of learners. The first teacher was aware of cultural differences but viewed this as a challenge in getting them to learn how to write very much like she did. The other 3 had different expectations for low socio-economic groups of learners, a cultural deficit view that expected less of such pupils and thus they became more directive and restrictive. The authors conclude that the teacher education program had not uncovered or challenged underlying and powerful views of teaching and learning that contradicted the view of the learner in the writing process curriculum.

Researcher	Objectives of Teacher Education Program	Theoretical Orientation of Paper	Major Findings/Implications about How People Learn How to Teach
Wubbels, Korthhagen & Dolk 1992	Intensive 4 year conceptual change program for teaching secondary mathematics which the process of "doing" math was emphasized more than the products of doing math. The student teachers were stimulated to reflect on their experiences as learners and problem solvers (ALACT model of reflection).	Conceptual change is important as far as this becomes visible in student teacher's behavior. As well as dealing with the role of prior beliefs, they deal with the role of student teachers' images in guiding behavior. They state that these images are formed and held in the right hemisphere of the brain and are accessible mainly with "right brain" techniques.	The program was only partially successful in producing conceptual change. Of the 10 remaining students, 8 still expressed views of teaching as transmission. More successful were the efforts in inducing attitudes in favour of a realistic view of mathematics teaching. They discuss reasons why the students' conceptions of teaching are so stable . They say that most approaches to conceptual change are left brain (logical and analytical) techniques and are thus likely to be unsuccessful. They propose strategy changes for improving the quality of reflection on images based on theories from cognitive psychology and information processing (Corporal, 1988 and Korthagen, 1992). They outline a 5 stage process, and use right brain language strategies (jokes, puns, figurative language, images, etc.) that they state are necessary to change student teacher's strongly held images of teaching.